

CLAIMS:

What is claimed is:

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1. A method for performing chroma suppression for an image sensor system, said method comprising the steps of:

a) determining the intensity of spatial frequency for a current processing pixel within a block of Bayer pattern by using edge detection that utilizes pixels values of green
10 pixels within said block of Bayer pattern; and

b) reducing the chromatic saturation of said current processing pixel based on said determined intensity of spatial frequency of said current processing pixel.

2. The method of Claim 1, wherein in said step a) said green pixel values are
15 taken from a line buffer adapted for buffering pixel values to be used for performing image interpolation.

3. The method of Claim 1, wherein in said step a) the intensity of spatial frequency of said current processing pixel is determined using exclusively said green
20 pixel values.

4. The method of Claim 1, wherein said region of Bayer pattern is a 4 X 4 block of pixels containing said current processing pixel M.

5. The method of Claim 4, wherein said step a) further comprises the steps of:

a1) calculating a first plurality of 4 first order pixel value sums $V[0]$ to $V[3]$, wherein an i-th pixel value sum $V[i]$ characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying on the i-th vertical column of said Bayer pattern region; and

a2) calculating a second plurality of 4 first order pixel value sums $H[0]$ to $H[3]$, wherein an j-th pixel value sum $H[j]$ characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying in the j-th horizontal column of said Bayer pattern region.

6. The method of Claim 5, wherein said step a) further comprises the steps of:

a3) calculating $V_{avg}[0] = V[0] + V[2]$ and $V_{avg}[1] = V[1] + V[3]$;
a4) calculating $V_{max} = |V_{avg}[0] - V_{avg}[1]|$;
a3) calculating $H_{avg}[0] = H[0] + H[2]$ and $H_{avg}[1] = H[1] + H[3]$; and
a4) calculating $H_{max} = |H_{avg}[0] - H_{avg}[1]|$.

7. The method of Claim 6, wherein a number GI is used to determine the intensity of spatial frequency of said current processing pixel, wherein said number GI is defined as the greater value of said two values V_{max} and H_{max} .

8. The method of Claim 7, wherein in said step b) said number GI is used to set the amount of reduction to be performed on the chromatic saturation of said current processing pixel.

5 9. A method for performing chroma suppression for an image sensor system, said method comprising the steps of:

a) determining whether or not a current processing pixel within a region of Bayer pattern is a green pixel;

b) irrespective of whether said current processing pixel being a green pixel or a
10 non-green pixel, accessing the pixel values of green pixels within said region of Bayer pattern that surround said current processing pixel;

c) calculating the intensity of spatial frequency of said current processing pixel using said accessed green pixel values; and

d) reducing the chromatic saturation of said current processing pixel based on said
15 calculated intensity of spatial frequency.

10. The method of Claim 9, wherein said step c) is performed during edge detection, wherein said accessed green pixel values are taken from a line buffer adapted for buffering pixel values to be used for performing image interpolation.

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11. A chroma suppression system for performing chroma suppression in an image sensor system, said chroma suppression system comprising:

an edge detection module adapted to detect edge within a Bayer pattern region,
said edge detection module adapted for determining the intensity of spatial frequency of a
current processing pixel by using green pixel values within said Bayer pattern region; and
a chroma suppression module coupled to said edge detection module, said chroma
5 suppression module adapted to reduce the chromatic saturation of said current processing
pixel based on said determined spatial frequency intensity of said current processing
pixel.

12 The chroma suppression system of Claim 11, wherein said green pixel
10 values are taken from a line buffer of an image interpolation module of said image sensor
system, said line buffer adapted for buffering pixel values to be used for performing
image interpolation.

13. The chroma suppression system of Claim 11, wherein said edge detection
15 module determines the intensity of spatial frequency of said current processing pixel by
using exclusively said green pixel values within said Bayer pattern region.

14. The chroma suppression system of Claim 11, wherein said region of Bayer
pattern is a 4 X 4 block of pixels containing said current processing pixel.

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15. The chroma suppression system of Claim 14, wherein said edge detection
module is adapted to perform the steps comprising of:

a) calculating a first plurality of 4 first order pixel value sums $V[0]$ to $V[3]$,
wherein an i-th pixel value sum $V[i]$ characterizes the pixel value sum for a pair of green
pixel values associated respectively with a pair of green pixels lying on the i-th vertical
column of said Bayer pattern region; and

5 b) calculating a second plurality of 4 first order pixel value sums $H[0]$ to $H[3]$,
wherein an j-th pixel value sum $H[j]$ characterizes the pixel value sum for a pair of green
pixel values associated respectively with a pair of green pixels lying in the j-th horizontal
column of said Bayer pattern region.

10 16. The chroma suppression system of Claim 15, wherein said edge detection
module is further adapted to perform the steps comprising of:

c) calculating $V_{avg}[0] = V[0] + V[2]$ and $V_{avg}[1] = V[1] + V[3]$;

d) calculating $V_{max} = |V_{avg}[0] - V_{avg}[1]|$;

e) calculating $H_{avg}[0] = H[0] + H[2]$ and $H_{avg}[1] = H[1] + H[3]$; and

15 f) calculating $H_{max} = |H_{avg}[0] - H_{avg}[1]|$.

17. The chroma suppression system of Claim 16, wherein a number GI is used
by said edge detection module to indicate the intensity of spatial frequency of said current
processing pixel, wherein said number GI is defined as the greater of said two values

20 V_{max} and H_{max} .

18. The chroma suppression system of Claim 17, wherein said number GI is used as a reference by said chroma suppression module for setting the amount of reduction to be performed on the chromatic saturation of said current processing pixel.

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19. A method for performing chroma suppression for an image sensor system, said method comprising the steps of:

a) irrespective of whether a current processing pixel being a green pixel or a non-green pixel, accessing the pixel values of Bayer pattern green pixels within a region of Bayer pattern that contains a current processing pixel;

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b) determining the spatial frequency of said current processing pixel using said accessed green pixel values; and

c) reducing the chromatic saturation of said current processing pixel based on said determined spatial frequency of said current processing pixel.

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20. The method of Claim 19, wherein in said step a) said pixel values of said green pixels are taken from a line buffer of an color interpolation module of said image sensor system, said line buffer adapted to buffer pixel values to be used for performing color image interpolation.

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21. The method of Claim 19, wherein in said step b) the intensity of spatial frequency of said current processing pixel is calculated using exclusively said green pixel values from said region of Bayer pattern.

22. The method of Claim 19, wherein said region of Bayer pattern is a 4 X 4 block of pixels containing said current processing pixel.

23. The method of Claim 22, wherein said step b) further comprises the steps
5 of:

b1) calculating a first plurality of 4 first order pixel value sums $V[0]$ to $V[3]$, wherein an i-th pixel value sum $V[i]$ characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying on the i-th vertical column of said Bayer pattern region; and

10 b2) calculating a second plurality of 4 first order pixel value sums $H[0]$ to $H[3]$, wherein an j-th pixel value sum $H[j]$ characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying in the j-th horizontal column of said Bayer pattern region.

15 24. The method of Claim 23, wherein said step b) further comprises the steps of:

b3) calculating $V_{avg}[0] = V[0] + V[2]$ and $V_{avg}[1] = V[1] + V[3]$;

b4) calculating $V_{max} = |V_{avg}[0] - V_{avg}[1]|$;

b3) calculating $H_{avg}[0] = H[0] + H[2]$ and $H_{avg}[1] = H[1] + H[3]$; and

20 b4) calculating $H_{max} = |H_{avg}[0] - H_{avg}[1]|$.

25. The method of Claim 24, wherein a number GI is used to determine the intensity of spatial frequency of said current processing pixel, wherein said number GI is defined as the greater of said two values Vmax and Hmax.

5 26. The method of Claim 25, wherein in said step c) said number GI is used to set the amount of suppression to be performed on said current processing pixel.

27. A method for improving quality of an image captured by an image sensor system, said method comprising the steps of:

10 a) locating area of said captured image that has spatial frequency higher than a reference value by using edge detection, wherein said edge detection uses a plurality of green pixels surrounding a current processing pixel to determine the intensity of spatial frequency of said current processing pixel; and

b) chroma suppressing said located area based on said determined spatial
15 frequency intensity of said current processing pixel.

28. The method of Claim 27, wherein said plurality of green pixels are taken from a line buffer of an image interpolation unit of said image sensor system, wherein said line buffer is adapted to buffer pixel values to be used for performing image
20 interpolation.

29. The method of Claim 27, wherein said step b) further comprises the step of:

reducing the chromatic saturation of said current processing pixel based on the said determined spatial frequency intensity of said current processing pixel.

30. A method for performing chroma suppression for an image sensor system,
5 said method comprising the steps of:

a) finding the intensity of spatial frequency for a current processing pixel within a block of Bayer pattern by using a plurality of green pixel values from said block of Bayer pattern, said green pixel values selected from pixel values adapted to be used for image interpolation; and

10 b) suppressing the chromatic saturation of said current processing pixel based on said found intensity of spatial frequency of said current processing pixel.

31. The method of Claim 30, wherein said plurality of green pixel values are taken from a line buffer adapted for buffering pixel values to be used for image
15 interpolation.

32. The method of Claim 30, wherein in said step a) the intensity of spatial frequency of said current processing pixel is determined using steps performed for edge detection, wherein said edge detection steps utilize pixels values of said green pixels
20 within said block of Bayer pattern.

33. The method of Claim 32, wherein in said step a) the intensity of spatial frequency of said current processing pixel is determined using exclusively said buffered green pixel values.

5 34. The method of Claim 30, wherein said region of Bayer pattern is a 4 X 4 block of pixels containing said current processing pixel.

35. The method of Claim 34, wherein said step a) further comprises the steps of:

10 a1) calculating a first plurality of 4 first order pixel value sums $V[0]$ to $V[3]$, wherein an i-th pixel value sum $V[i]$ characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying on the i-th vertical column of said Bayer pattern region; and

a2) calculating a second plurality of 4 first order pixel value sums $H[0]$ to $H[3]$,
15 wherein an j-th pixel value sum $H[j]$ characterizes the pixel value sum for a pair of green pixel values associated respectively with a pair of green pixels lying in the j-th horizontal column of said Bayer pattern region.

36. The method of Claim 35, wherein said step a) further comprises the steps
20 of:

a3) calculating $V_{avg}[0] = V[0] + V[2]$ and $V_{avg}[1] = V[1] + V[3]$;

a4) calculating $V_{max} = |V_{avg}[0] - V_{avg}[1]|$;

a3) calculating $H_{avg}[0] = H[0] + H[2]$ and $H_{avg}[1] = H[1] + H[3]$; and

a4) calculating $H_{\max} = |H_{\text{avg}}[0] - H_{\text{avg}}[1]|$.

37. The method of Claim 36, wherein a number GI is used to determine the intensity of spatial frequency of said current processing pixel, wherein said number GI is
5 defined as the greater value of said two values V_{\max} and H_{\max} .

38. The method of Claim 37, wherein in said step b) said GI is used to set the amount of suppression to be performed on said current processing pixel.

10 39. A chroma suppression system for performing chroma suppression in an image sensor system, said chroma suppression system comprising:
an edge detection unit adapted for detecting false color of a current processing pixel by using the intensity of spatial frequency of said current processing pixel; and
a chroma suppression unit coupled to said edge detection unit, said chroma
15 suppression unit adapted for reducing the chromatic saturation of said current processing pixel in response to false color being detected for said current processing pixel, wherein the amount of chromatic saturation reduction is performed according to the intensity of spatial frequency of said current processing pixel.

20 40. The chroma suppression system of Claim 39, wherein said intensity of spatial frequency of said current processing pixel is determined without needing to use pixel values of non-green pixels surrounding said current processing pixel.

41. The chroma suppression system of Claim 40, wherein said intensity of spatial frequency of said current processing pixel is determined using green pixel values of a plurality of green pixels surrounding said current processing pixel, said green pixel values taken from a line buffer adapted for buffering pixel values to be used for

5 performing image interpolation.